Map-Based Isotopic Kinetical Tool to Simulate the Generation and Accumulation History of Natural Gas

Wang, Feiyu [1]; Tang, Yongchun [2]; He, Zhiyong [3]; Li, Jinkun [4]; Zhen, Huasen [4] (1) China University of Petroleum, Beijing, China. (2) Power, Environmental, and Energy Research Center, Covina, CA. (3) ZetaWare, Inc., Sugar Land, TX. (4) Petro China Daqing Oilfield Company, Daqing, Helongjiang 163453, China.

Gas yields and isotope kinetics algorithms have be used in conjunction with basin modeling (Trinity) to quantify gas generation in the source kitchen and fetch area and accumulation history in the play and prospect. Gas yields and isotope kinetics algorithms derived from GOR technique and new experimental data of the typical lacustrine and coal measures source rocks in Chinese basin, which uses the temperature-dependent fractionation of stable carbon isotopes in individual gas compounds calibrated with direct closed and open system pyrolysis measurements of quantities and isotopic compositions of gases generated from specific source rocks or through secondary cracking of oil. Charge volume history of the play and prospect are calculated from expelled volumes from the fetch areas, on the other hand, gas composition and carbon isotope in the mode of instantaneous,cumulative and intervenient also calculated for expelled volume gas from the fetch area, possible scenario of gas generation and accumulation history were postulated through comparison measured carbon isotope data with calculated results. Two case studies will be presented to illustrate how the new map based chemical kinetical quantitative tool to determine the origin of natural gas, source kitchen and fetch area, charge history, the first case is Qingshen gas field in Xujiaweizi rift depression, Songliao Basin, where the half of gas samples with the peculiar reversal in the distribution of the carbon isotopic values of the hydrocarbon gases with increasing carbon number, the origin of natural gas is controversial whether either mixing of gases generated from variable source kitchen at different thermal maturity levels or significant contribution of abiogenic gases, our results indicate that the peculiarity and variability of carbon isotope in this area were related to the stratigraphic and thermal history variability of Upper Jurassic-Lower Cretaceous coals and associated dark mudstones, and minor lacustirine oil prone mudstones. The second case is Kuche gas field in Tarim basin, where map based quantitative analysis of source kitchen and cumulative gas accumulation history may explain the variability of gas composition and isotope.