The TSM Basin Modelling System and Petroleum Exploration

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ABSTRACT

As Perrodon and Masse (1984) pointed out, there would be no petroleum if there are no basins present. The geological processes in a petroliferous basin and the associated petroleum responses are complex. Our understanding of basin evolution is limited by the scarce and scattered information available. The co-existence and superposition of prototype basins of different ages over long geological history also lead to the formation of varieties of basins. This may cause unexpected "surprises" during petroleum exploration. It has been shown that because the vast size and the prolonged history of basin evolution, the true geohistory of a basin is often modified or completely eliminated during the dynamic basin evolution. Numerical modelling provides a way to reconstruct the geohistory of a basin from what we have seen (got) today, and to unravel the basin evolution, hydrocarbon generation, migration and accumulation processes. However, as the construction of the geological model is essential prior to basin modelling, Waples proposed to use a profound Sophistication Model to numerically simulate the evolution of petroliferous basins and to document hydrocarbon generation, expulsion, migration and accumulation, to determine exploration uncertainties and discover oil fields.

We consider the 3T-4S-4M algorithm as the overall guide for the TSM basin modelling system, and establish the most "plausible " geological model according to the tectonic-thermal system that is characteristic of the prototype basins in different stages. The boundary conditions are constrained by overlaying various geological processes. Then, the dynamic relationships between the geological functions and hydrocarbon responses can be simulated during the basin evolution through deterministic modeling.