Modeling Gas Hydrate Petroleum Systems of the PleistoceneTurbiditic Sedimentary Sequences of the Daini-atsumi Area, Eastern Nankai Trough, Japan

Tetsuya Fujii[1], Than Tin Aung[2], Naoya Wada[2], Yuhei Komatsu[1], Kiyofumi Suzuki[1], Bjorn Wygrala[3], Thomas Fuchs[3], Wolf Rottke[3], and Kosuke Egawa[4]

[1]1. Methane Hydrate Research & Development Group, Technology & Research Center, Japan Oil, Gas and Metals National Corporation (JOGMEC)
2. Schlumberger K.K.
3. Schlumberger Aachen Technology Center
4. National Institute of Advanced Industrial Science and Technology (AIST) (Current affiliation: INPEX Corporation)

ABSTRACT

We performed 2D and 3D gas hydrate (GH) petroleum systems modeling for the Pleistocene turbiditic sedimentary sequences distributed in the Daini-Atsumi area in the eastern Nankai Trough to understand the accumulation (concentration) mechanisms and their spatial distribution related to the geological and geochemical processes. High-resolution seismic facies analysis and interpretations were used to define facies distributions in the models. We created a new biogenic methane generation model based on biomarker analysis using core samples and incorporated into our model. 2D models were built and simulated to confirm the parameters to be used for 3D modeling. Global sea level changes and paleo-geometry estimated from 3D structural restoration results were taken into account to determine the paleo-water depth of the deposited sedimentary sequences. Pressure and temperature distributions were modeled because they are the basic factors that control the GH Stability Zone (GHSZ).

2D modeling results suggest that the setting of biogenic methane generation depth is one of the most important controlling factors for GH accumulation in the Nankai Trough, which may be related to the timing of methane upward migration (expulsion) and methane solution process in pore water. 3D modeling results suggest that the distribution of sandy sediments and the formation dip direction are important controlling factors in the accumulation of gas hydrates. It was also found that the simulated amount of gas hydrate accumulation from the petroleum systems modeling compares well with independent estimations using 3D seismic and well data. This suggests that the model constructed in this study is valid for this gas hydrate system evaluation and that this type of evaluation can be useful as a supplemental approach to resource assessment.