

Investigation of Gas Hydrate Petroleum System in the Miyazaki-oki Forearc Basin, Japan: Preliminary Results

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JOGMEC Methane Hydrate R&D Group has been conducting long-term feasibility studies to assess the available gas hydrate resources in the eastern Nankai Trough, Japan. In order to understand methane generation, migration and accumulation mechanism of gas hydrate, petroleum system modeling (PSM) approach has been utilized for the resource assessment study of the eastern Nankai Trough with provable results. We have applied the modeling approach of the eastern Nankai Trough study in exploring methane hydrate resource assessment of Miyazaki Oki area. This study presents preliminary results of 1D and 2D modeling study of Miyazaki Oki area in investigating sensitivity of lithology and petroleum systems parameters to simulate gas hydrate stability zone (GHSZ) to match with interpreted bottom simulating reflectors (BSRs).

Study area comprises lower Miocene to Pleistocene, deep to shallow marine sedimentary successions of Hyuganada group and Miyazaki Group overlain the basement Shimanto Group. Based on 6 interpreted sequence boundaries from 3D migration seismic and velocity data, construction of a depth 3D framework model is made and distributed by a conceptual submarine fan depositional facies model derived from seismic facies analysis and referring existing geological report. In contrast to the eastern Nankai Trough, the Miyazaki Oki area is lack of calibration data such as pressure and temperature but an exploratory well, Udo Oki-1X, was drilled in the vicinity of the study area. The exploratory well covers most of Miyazaki group where geochemical data, lithology, temperature and vitrinite reflectance are available. Referring to this well, pseudo wells are constructed and sensitivity analyses of lithology and petroleum system parameters are performed. These 1D pseudo well results are applied to 2D modeling and migration simulation. Biogenic methane generation models, Gaussian distribution with peak temperature (model applied in the eastern Nankai Trough models) and Middleburg model based on sedimentation rate, were applied to generate biomethane. PetroMod compaction and permeability curves are assigned for each lithology and hybrid algorithm (combination of Darcy and Flowpath) were used in migration simulation process.

The 2D modeling study has confirmed that lower boundary of GHSZ at pseudo wells has been simulated with sensitivity of a few tens of meters in comparing with interpreted BSR. Furthermore in terms of geological properties, as gas hydrate accumulation increases, trends of reducing effective porosity and permeability are also observed accordingly. Preliminary results of 1D and 2D modeling will be applied to 3D model to investigate migration of biomethane and accumulation of methane hydrate in spatial distribution. As the future works, simulation run of 3D base case model, investigation of structural development and updating facies distribution are planned to perform.

Keywords: Miyazaki Oki, Gas Hydrate Stability Zone, Petroleum System Modeling, BSR