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Methane Hydrate trapping system of the turbidite channel complex in Daini-Atsumi Knoll, eastern Nankai Trough, Japan

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The 1^{st} offshore gas hydrate production test was conducted at gas hydrate concentrated zone (reservoir) of the Eastern Nankai Trough, which is considered stratigraphic accumulation. However, the accumulation mechanism for this concentrated zone is not yet well understood.

In this study, in order to examine gas hydrate trapping system in the accumulation mechanism, we identify the depositional process and controlling factors based on facies analysis and sequence stratigraphy using the core and geophysical log data.

Seven depositional sequences are identified based on grain size, bed thickness, sedimentary structure, and stacking pattern in this study. The sequence boundaries are also identified by terminations of seismic reflection. These sequences are attributed to a fourth to fifth-order eustatic sea-level changes, because the stacking pattern cycle is in phase with global oxygen isotope curves, the cycle is also identified in the onshore formation during the same period. The reservoir was interpreted as Falling-Stage Systems Tract (FSST) and Lowstand Systems Tract (LST).

In the reservoir, it was observed the channel complex set characterized by relatively strong reflections and paleocurrent flowing from northeast to southwest on 3-D seismic data. The channel complex set changes into muddy facies in the south direction. The channel complex set is characterized by hemipelagic setting or slope (F1), abandonment mud drape (F2), nonamalgamated channel element (F3), and semiamalgamated channel element (F4). The channel elements (F3, 4) are the fundamental unit and record a single phase of downcutting and filling. The muddy deposits (several 10 m; F1) above reservoir are interpreted as condensed section because they are consistent with a peak of foraminifer abundance. The condensed section divide different sediments of gas hydrate saturation.

These features suggest that condensed section deposits become top seal and channel deposits interpreted as FSST and LST become reservoir in gas hydrate trapping formation. The trapping system has the ability to seal lateral gas leakage because the channel reservoir is located around structural wing, the direction of sand pinch-out to structural highs becomes oblique to the direction of sediment supply. Consequentially, gas hydrate trapping system is constrained by sedimentary facies, systems tracts, and geographic and tectonic setting. Concepts and data generated in this study can be used for gas hydrate petroleum system analysis such as basin simulation.

Keywords: gas hydrate system, sequence stratigraphy, sea level change, submarine channel, sedimentary facies