

Drilling issues to methane hydrate concentrated zones in the eastern Nankai Trough

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In FY 2003, a drilling campaign for MH exploration which is named 'METI Exploratory Test Wells Tokai-oki to Kumano-nada' (Exploratory Test Wells FY2003), was conducted in the eastern Nankai Trough, Japan. JOIDES Resolution as known as the ODP scientific riserless drillship was chartered for the campaign and total 32 wells were drilled with seawater in the east Nankai Trough. By the interpretations after the campaign, MH-bearing layers which has potential to develop in the eastern Nankai Trough were identified 'a pore-filling MH in sandy sediments derived from turbidite', and named 'MH concentrated zones' (MHCZ). MHCZs would have a potential of development of methane gas production in future. The results of the Exploratory Test Wells FY2003 will be reviewed and the drilling issues to drill MHCZs will be mentioned.

(1) Drilling into MHCZs

The caliper and FMI data of logging showed stable borehole diameters in intervals of MHCZs. Furthermore decreases of ROP (Rate of Penetration) and increases of WOB (Weight on Bit) during the drilling operations in intervals of MHCZs were recognized. These results must indicate that MHCZs are mechanically strong. No methane gas leakage was observed during the drilling operations in MHCZs by ROV. MH in drilled sediments must ascend in annulus with partial dissolution/dissociation, and be dissolved into seawater above seafloor.

(2) Drilling into free gas zones

During the drilling operations into free gas zones just below MHCZs, no methane gas leakage from boreholes on seafloor was observed by ROV. Free gas zones just below MHCZs in the eastern Nankai Trough could be occupied by low saturation gas, and the gases must be dissolved in seawater in annulus during the drilling operations. Significant borehole enlargements were recognized in free gas zones by caliper data. These borehole enlargements may be not caused only problems during cementing and well completion but also production problems during production.

(3) Cementing in MHCZs

In the Exploratory Test Wells FY2003, a cementing (SG of slurry = 1.37) test after a casing set into a vertical well was conducted. The excess 150% cement was injected, however, no return was observed on seafloor. It was confirmed by cement evaluation logs that the cement slurry covered on MHCZ. Cement bonding ratio in the cementing interval including the MHCZ was estimated 70%. It needs more consideration about cement bonding for MHCZs and selection or development of cement corresponding to the low specific gravity, low temperature and low fever.

(4) Horizontal Well into MHCZ

Horizontal well has a potential for high production efficient because of surface of contact with borehole and MH-bearing sediment. MH-bearing layers exist in shallow sediments beneath seafloor, therefore, high dog-legs of well path is needed to reach to 90deg angle within short vertical intervals. The increment of well inclination in soft formations and the hole stability were matters of concern. In the Exploratory Test Wells FY2003, an operation of horizontal well drilling into a MHCZ was carried out successfully. However casing set and cementing in high angle drilling section was not conducted. New test well in future is hoped for.

In riserless drillings with seawater, no drilling issue except cementing was recognized. However there would be a possibility to use riser during well completion and production test. In that case, we should investigate other drilling issues based on the drilling procedures.

This study is conducted as a part of studies by MH21.