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CMR log analysis of the First Offshore Production Test at Daini-Atsumi knoll in the eastern Nankai Trough

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As preparatory drilling operations for the first offshore methane hydrate(MH) production test, monitoring wells (AT1-MC and AT1-MT1) and the upper part of production well (AT1-P) were drilled in FY2011. To confirm methane hydrate bearing circumstances, logging while drilling (LWD) and wireline logging (WL) were performed in AT1-MC. The production test was started on March 12, 2013. After a large amount of sand was produced on March 18, the production test was closed. During well-abandonment operations in August 2013, two LWD wells (AT1-LWD1 and AT1-LWD2) were drilled around the AT1-P, and open-hole WL were performed at the two wells.

The objectives of this study are to understand the characteristics of MH reservoirs and to confirm dissociation behavior of MH in the offshore production test field by analyzing logging data acquired in the wells that of AT1-MC, LWD1 and LWD2, especially CMR(Combinable Magnetic Resonance ; principle is same as Nuclear Magnetic Resonance) logging data. In AT1-MC, we acquired CMR data before the Test. In AT1-LWD1 and LWD2, we acquired CMR data after the Test.

CMR can measure T2 relaxation time, which indicates the amount of proton. But it can not measure rigid proton like in the ice, also included in MHs. This feature is usable to estimate MH dissociation behavior. Because, if the MH dissociate, water volume increase in the sediment. It may cause the change of T2 distribution that T2 relaxation time shifts to the longer time and the peak of T2 distribution increases. In addition, T2 distribution includes pore size information that short T2 relaxation time correspond to smaller pore and long relaxation time correspond to larger pore. Therefore, we might be able to discuss dissociation behavior.

In this study, we compared log plot of AT1-MC, LWD1 and LWD2. We can confirm some T2 distribution shift to the longer relaxation time in MH-bearing sandy layer in the AT1-LWD1, LWD2. Then, to observe the details, we separate the relaxation time to 8 bins. As a result of comparison of T2-mean(T2 logarithmic mean) in the each bin, T2-mean shift particularly observed in short relaxation time interval. The T2-mean of short relaxation time about AT1-LWD1 and LWD2 is longer than AT1-MC. It probably indicates dissociation of MH.

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Keywords: Methane Hydrate, NMR