

Density structure of the pore-filling-type methane-hydrate reservoir at the Daini-Atsumi Knoll, Central Japan

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The permeability of methane hydrate sediments is controlled by the lithology of the sediments and the saturation of methane hydrate in pore spaces. Thus, estimates of porosity in the reservoir are important. However, sediments in gas hydrate reservoirs are soft; thus, disturbances during drilling easily degrade the quality of data, despite the sediment-reinforcing effects of gas-hydrate crystals. Hence, methods for correcting the measured properties of sediments are quite important. We obtain the density (porosity) structure of sediments within and above the methane hydrate reservoir. Due to uncertainties in the density logs, we corrected the logs using borehole caliper data, which is sometimes negatively correlated with density. The corrected density data agreed well with results inferred from analysis of sediments recovered in pressure cores. On these samples, we conducted mercury injection porosimetry on frozen depressurized samples from 2004 and 2012 and also determined density from the onboard multisensor core logger (MSCL) data on conventional cores, especially in methane hydrate concentrated zone (MHCZ). Our results allow us to divide the sediments above the gas hydrate stability zone (GHSZ) on Daini-Atsumi Knoll into four zones. The zone boundaries correspond to facies boundaries. This implies that the sedimentary facies strongly influenced not only the lithology, but also physical properties such as density (porosity).

Keywords: Gas hydrate, Logging-while-drilling (LWD), Density log, Borehole enlargement, Sedimentary facies