

Long-term monitoring of temperature distribution in methane hydrate bearing sediments in Nankai Trough

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In the Nankai Trough, seismic data indicates widespread existence of BSR, which is interpreted as an indicator of bottom boundary of methane hydrate bearing zone. Methane hydrate is regarded as future possible natural gas resource, although the mechanisms of its occurrence and distribution have been poorly understood. In order to obtain data for the understanding of methane hydrate occurrence and natural reserves estimation, METI exploratory test wells 'Tokai-oki to Kumano-nada' were drilled from January to May in 2004. As a part of this project, continuous formation temperature measurement in hydrate bearing sediments in ocean area, the first attempt in the world, was carried out in order to investigate in-situ temperature condition in hydrate bearing sediments.

Optical fiber sensor was used for the measurement of temperature distribution. Sensor cable was set in the borehole, with the measurement system (data logger) set above the seafloor. 2 kinds of sensor cable, DTS (Distributed Temperature Sensor) and FBG (Fiber Bragg Grating), were set in the borehole.

Continuous temperature distribution data for 50 days was obtained successfully at the location where pore space type hydrate was confirmed in sand layer by coring. Averaged temperature depth profile was constructed after analysis such as data conversion, quality control, evaluation of temperature stability, temperature correction and depth correction.

The thermal gradient obtained from temperature profile showed good matching with expected thermal gradient in this area (3C/100m), below hydrate bearing zone. On the other hand, apparent lower thermal gradient was observed in hydrate bearing zone. Another results using well log and core data on the effect of fluid flow indicated that temperature was mainly affected by seafloor temperature or fluid flow in shallower zone, while it was mainly affected by another geological aspects such as fracture, faults, hydrate, lithology variation, at deeper part.

These results are expected to be utilize for the investigation of hydrate stability zone by compared to the phase diagram of hydrate obtained from hydrate synthesis experiments. They are also expected to give us useful information to answer the cause of double BSR occurrence. Temperature is one of the most important parameters for hydrate development Further detail analysis of these data is expected to give us further important information.