Delineation of methane hydrate-bearing sediments by using the seismic data and well logging data

Takao Inamori[1]; Toshiaki Kobayashi[1]; Naoyuki Shimoda[1]; Masao Hayashi[1]; Sadao Nagakubo[2]; Tetsuya Fujii[1]; Tatsuo Saeki[1]

[1] JOGMEC; [2] JOGMEC/JDC

It is known the velocity of methane hydrate is about over 3,000m/s (example, Helgerud, 2001). The P-wave velocity of methane hydrate-bearing sediments is larger than that of the sediments without methane hydrate. By the sonic log of wells drilled in the eastern Nankai Trough, the higher velocity zones correspond to the sediments containing methane hydrate.

Bottom Simulating Reflectors (BSRs) are recognized widely in the eastern Nankai Trough. It had been thought in past that methane hydrate-bearing sediments above the BSRs distributed homogenously. However, according to the analysis of well log data acquired in the eastern Nankai Trough, it was recognized that methane hydrate-bearing sediments did not distribute homogenously but heterogeneously, and the distributions are restricted by the distributions of sandy layers. It is also recognized that the saturation of methane hydrate in the sandy sediments are over the 70 % in some cases, however, it is inferred that the saturation in the shaly sediments are less than 5%. According to the analysis of well log data acquired in the eastern Nankai Trough, sandy sediments which reserve highly-concentrated methane hydrate are divided into channel-type or lobe-type sandy sediments derived from turbidite. The sediments derived from turbidite are characterized as very complicated geological bodies which deposited as sand/mud alternative layers.

The Research Consortium for Methane Hydrate Resources in Japan (MH21) defined the complicated sandy bodies derived turbidite with highly-concentrated methane hydrate as methane hydrate concentrated zones, and conducted a resource assessment of methane hydrate by probabilistic approach in the eastern Nankai Trough (Fujii et al., 2007).

However, it is quite difficult to recognize the differences in seismic images from BSR appearances methane hydrate-bearing sediments and no-methane hydrate-bearing sediments. BSRs appear in seismic images as impedance contrast near boundaries between methane hydrate-bearing sediments and no-methane hydrate-bearing sediments with brine or small amount of gas in the pore.

On the other hand, there are some differences of the velocity profile between the methane hydrate-concentrated zones and the no-concentrated zones. The velocity profiles are good index for methane hydrate saturation or concentration.

Our goal is to delineate the reservoir where contains the methane hydrate, how much methane hydrate contains and how methane hydrate contains in sediments by using the seismic data and well logging data.

This study has been conducted as a part of the research undertaken by MH21.