Summary of resource assessment of marine natural methane hydrate around Japan: historical review and current state

Mikio Satoh[1]; Tetsuya Fujii[2]; Tatsuo Saeki[2]; Sadao Nagakubo[3]

[1] GSJ,AIST; [2] JOGMEC; [3] JOGMEC/JDC

Resource assessment of marine natural methane hydrate around Japan is summarized in following 3 phases.

1. before MITI seismic survey and exploratory well 'Nankai Trough'(-1996)

The first estimation for resources of marine natural methane hydrate around Japan was conducted by US DOE on volumetric method as 1.1 x $10^{11}m^3$(4TCF) per 1m thickness of hydrate layer (Ciesnik and Krason, 1989). Krason(1994) estimated at 4.2 x $10^{11}m^3$(15TCF) and 4.2 x $10^{12}m^3$(150TCF) in case of 1m and 10m thickness of hydrate layer respectively. Satoh et al.(1996) estimated at 2.71 x $10^{12}m^3$ as hydrate gas and 1.6 x $10^{12}m^3$ as free gas just below hydrate layer in the Nankai Trough, and 4.65 x $10^{12}m^3$ as hydrate gas and 2.7 x $10^{12}m^3$ as free gas around Japan. Those estimations were based on volumetric method with distribution of BSR and average thickness of hydrate layer, and resources around Japan was extrapolated from those of western Nankai Trough (off Shikoku). Because of no indicator for upper limit of hydrate layer on seismic profiles and no drilling data at BSR distribution area in that time, uncertainty of the estimation were considerably remained

2. after MITI seismic survey and exploratory well 'Nankai Trough'(-2002)

MITI 2D seismic survey 'Nankai Trough' was carried out in 1996 and MITI exploratory well 'Nankai Trough' was drilled in 1999-2000 at the eastern Nankai Trough area, and first drilling data was obtained from the well located in BSR distribution area. Satoh (2001, 2002) revised the estimation of resources of marine methane hydrate around Japan at 4.13-20.64 x $10^{12}m^3$ with 2-10m average thickness of hydrate layer based on new BSR distribution data and drilling data, and more than 80-90% of those are distributed in Nankai Trough area. Pore space hydrate in turbidite sand layer was regarded as target of resources, and free gas just below hydrate layer were not regarded as resources.

3. after METI seismic survey and exploratory well 'Tokai-oki to Kumano-Nada' and MH21 phase-1(-recent)

METI 2D/3D seismic survey 'Tokai-oki to Kumano-Nada' was carried out in 2001 and 2002, and METI exploratory well 'Tokai-oki to Kumano-Nada' was drilled in 2004 at the eastern Nankai Trough area. Precise resource assessment through probabilistic approach using the seismic and drilling data of METI 'Tokai-oki to Kumano-Nada' was conducted and reported in 2007 by Research Consortium for Methane Hydrate Resources in Japan (MH21). After these assessment, total resources in the eastern Nankai Trough area are 11.4 x $10^{11}m^3$(about 40TCF) as Pmean value, and 5.74 x $10^{11}m^3$(about 20TCF) as in the 'MH concentrated zones' and 5.68 x $10^{11}m^3$(about 20TCF) in the other area (Fujii et al., 2007, 2008). This assessment is based on the concept of 'MH concentrated zones', which was first time recognized in the world.

4. evaluation of the estimated resources compared with annual consumption of natural gas in Japan

The estimation value of total resources of marine natural methane hydrate around Japan by Satoh et al. (1996) is usually corresponded to 100 years annual gas consumption in Japan. But annual consumption of natural gas in Japan was 5.4 x $10^{10}m^3$ in 1994, 7.5 x $10^{10}m^3$ in 1999 and 8.2 x $10^{10}m^3$ in 2005, increasing 1.5 times during 11years. Following discussion we use the value in 2005. The estimation value of total resources around Japan by Satoh (2001, 2002) are corresponded to 20-252 years annual gas consumption in Japan. On the other hand, those of eastern Nankai trough by Fujii et al. (2007, 2008) are corresponded to 14 years one, 7 years in 'MH concentrated zones' and 7 years in the other area. Considering that areal extent of BSR in the eastern Nankai Trough occupied only 9% of total distribution of the BSR around Japan, the estimated value of that area is considered promising.