Characteristics of natural gas hydrate retrieved at northern central Baikal basin

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Lake Baikal (Russia) is the solitary example of hydrate-bearing area in the environment of fresh water. Gas hydrate samples in sandy turbidites were first obtained at the southern Baikal basin in the Baikal Drilling Project in 1997. Multi-phase Gas Hydrate Project (MHP, 2009-2014), the international collaboration between Japan, Russia, and Belgium, has revealed distribution of gas hydrate in sub-bottom sediment at the southern and central Baikal basins. In the last cruise (MHP-14) we obtained gas hydrate crystals from four new places (Kukuy K-5, Khoboy, Akadem Ridge, and Barguzin) at the central Baikal basin. We report the characteristics of hydrate-bound gases at these sites.

Samples of hydrate-bound gas were obtained onboard and stored in 5-mL vials. We measured molecular and stable isotope compositions of the samples. According to the $\frac{C_1}{C_2} - \delta^{13}C$ diagram (Bernard \textit{et al}. 1976), the $\delta^{13}C - \delta D$ diagram for $C_1$ (Whiticar, 1999), and the $C_1$-$\delta^{13}C - C_2$-$\delta^{13}C$ diagram (Milkov, 2005), the gas characteristics show the following information:

1) Hydrocarbons at the Khoboy, Akadem Ridge, and Barguzin are microbial origin, and those of Kukuy K-5 is in the field of mixed-gas between microbial and thermogenic gases.

2) In the "Bernard diagram", hydrate-bound hydrocarbons of Kukuy K-5 locate on the mixing line of microbial gas at the Kukuy K-9 and thermogenic gas at the Kukuy K-4, those are the end members at the Kukuy Canyon area.

3) $C_2 \delta^{13}C$ of the hydrate-bound gas at the the Khoboy, Akadem Ridge, and Barguzin are low (less than -50 °), indicating microbial $C_2$. Microbial $C_2$ in the hydrate-bound gas has been observed at the Krasnyi Yar and Peschanka P-2 at the southern Baikal basin, and the Ukhan and Unshuy at the central Baikal basin.

4) The site Barguzin locates only 7 km distance from the site Gorevoy Utes, where oil-stained gas hydrate with thermogenic gas was retrieved.


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