WATER FLOW WITH GAS VENTING INFLUENCING ON HYDRATE ACCUMULATION AT SEEP SITE: APPLICATION TO THE SOUTHERN SUMMIT OF HYDRATE RIDGE, CASCADE MARGIN OFF OREGON

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ABSTRACT

Gas seeps widely occurred on seafloor and gas hydrates crystallized from this venting gas in the subsurface of continental slope where temperature and pressure is suitable for hydrate formation. Hydrate Ridge is a typical site of venting gas precipitated hydrate. With gas migration, water also flowed from deep with high temperature to surface with low temperature. This water and gas transportation from deep to surface increased temperature and decrease salt content of pore water, and will influence on hydrate accumulation. We developed a kinetic model for gas hydrate crystallized from gas flow from deep to sea surface, and considered fluid convection, salt-removing, ion diffusion, heat conduction and the latent heat of hydrate crystallization in calculation, and then use it to simulate hydrate crystallization at the southern summit of the Hydrate Ridge. We set the initial chloride as ambient seawater value (0.558 M), initial thermal gradient as 53 °C/km at ODP site 1247, where the hydrate content is lower and chloride reaches nearly seawater value, and gas vent rate at seafloor as steady as 1.9 kg/m$^2$-yr (Torres et al., 2002). The seafloor temperature is 4.3 °C, that was measured at ODP1249 and ODP1250 seafloor (Trehu et al., 2003, 2004). To match the measured chloride and hydrate content at ODP drilling sites at southern Hydrate Ridge summit, vent gas precipitated as hydrate in the subsurface needs ~650yr and water flux needs less than 5 kg/m$^2$-yr at ODP1249, and needs ~200 yr and water flux needs ~100 kg/m$^2$-yr at ODP1250. With the increase of water flux the base of hydrate stability zone would uplift to near surface and gas hydrate accumulated in the subsurface would decrease greatly.

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