Geological and Geochemical Characteristics of Gas Hydrate in the Qilian Mountain Permafrost, Qinghai Province, China

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ABSTRACT
Gas hydrate was obtained in the Qilian Mountain permafrost in Qinghai, China. It occurs in fissures of mudstone, oily shale, siltstone, fine sandstone, and in the pore space of fine to middle grained sandstone between 133 to 396 mbs. Gas hydrate is composed of CH4, C2H6, C3H8, and CO2 indicated by Raman spectrometry. Gas composition and isotope geochemistry show that gases from gas hydrate mainly originate from thermo-genesis. Furthermore, a practical formula is put forward for estimation of gas hydrate resources and the total amount is estimated to be 446.5 × 10^4 m^3 methane within the drilling area.

KEY WORDS: Gas hydrate, permafrost; characteristics; Qilian Mountain; China.

INTRODUCTION
Gas hydrate, commonly called “flammable ice”, is a kind of crystal material which is formed from water and light gases (such as CH4, C2H6, C3H8, i-C4H10, H2S, CO2, etc.) under low temperature (70~350K, usually around 273.15K) and high pressure (more than 3~5 MPa, maximally to 2000 MPa) conditions when gas concentration is greater than its solubility (Sloan, 1998; Kvenvolden, 1995; Makogon et al., 2007). Naturally gas hydrate occurs in marine subsurface sediments with water depth of greater than 300m or in permafrost sediments/rocks with subsurface depth of more than 130m (Kvenvolden, 1995; Shi and Zheng 1999). Because of containing highly compressed natural gas, gas hydrate is thought of a potential energy source in future (Kvenvolden, 1995; Milkov and Sassen., 2002). The dynamic behavior of gas hydrate in natural environments equivocally has a feedback on climate change (Dickens, 2004) and geohazard (Mienert et al., 2005), even posing a threat to drilling and production operations (Collett and Dallimore, 2002). Hence it needs to ascertain gas hydrate occurrence and distribution around the world.

Since the first gas hydrate was discovered in the Messoyakha gas field of the western Siberia permafrost, Russia in 1960s (Makogon et al., 2007), many other permafrost associated gas hydrates have been sampled in the North Slope area of Alaska, US (Collett, 1993) and the Mackenzie delta, Canada (Dallimore et al., 1999). A test production of permafrost associated gas hydrate happened in the Mallik wells of the Mackenzie delta (Dallimore et al., 2005; Moridisa et al., 2004; Craven et al., 2009), indicating economic viability of gas production from gas hydrate (Walsh et al, 2009).