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Application Process of Iodine System in the Gas Hydrate

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As a new energy source, gas hydrate has shown important economic significance. Although the total mass remains unclear, it is consensus that the gas hydrate is a major hydrocarbon reservoir in Earth's surface (Milkov, 2004). Bottom-simulating reflector (BSR) on seismic profiles is a main means to identify the gas-hydrate deposits in current surveys. However, scientific drilling indicated BSR did not be found in some of sea area, where collected gas hydrate. BSR is neither the best nor only indicator for the presence of gas hydrates. Thus, more or comprehensive means are need to identify the gas hydrate accurately in the ocean.

Given the close association of I with organic matter and the similarity in diffusion coefficients between I^- and CH_4, it is likely that these two compounds are transported together in aqueous fluids and that I can be used as a new and effective proxy for identifing the gas hydrate and the origin of CH_4 in gas hydrate fields (Fehn et al., 2000; Muramatsu et al., 2007; Tomaru et al., 2015).

1 Iodine Geochemistry and Application

Iodine is a strongly biophilic element and is commonly associated with organic matter in marine environments. After sedimentation and burial of organic-rich sediments, iodine is released into aqueous phases typically during the decomposition of organic particulates, but a large fraction of that iodine is returned back into the overlying seawater (Tomaru et al., 2015). *

Iodine concentration in pore waters from marine sediments is higher than that in seawater of 0.4μmol/L. In gas hydrate fields, it always increases rapidly with depth and reach values several orders of magnitude higher than that in seawater (Fehn et al., 2003; Tomaru et al., 2007; Kim et al., 2013). Thus, based on this observation, the strongly enriched iodine concentrations in the pore water can be used to identify occurrence of the gas hydrate.

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2 ^{129}I/I ratios and Application

As a long-lived radioisotope with a half-life of 15.7 Myr, ^{129}I is mainly produced by the spallation reaction of Xe in the atmosphere and by the spontaneous fission of ^{238}U in the earth's crust in nature. The presence of the cosmogenic isotope ^{129}I provides an opportunity for dating and tracing fluids derived from organic-rich formations, which improves our understanding of origin and history of organic matter.

The ^{129}I/I ratios have been applied in several well-known gas hydrate fields such as Blake Ridge, Hydrate Ridge, and the Japan Sea (Fehn et al., 2000, 2007; Tomaru et al., 2007, 2015; Lu et al., 2008). Previous studies indicated pore waters generally show older ^{129}I/I isotopic ages than the local host sediment, suggesting that iodine and methane probably derived from other older sources.

3 Summary

The South China Sea is a favorable place for the formation and accumulation of the gas hydrate. Most surveys suggest that there is likely huge potential of gas hydrate resources, but the exactly station of gas hydrate deposits is hardly to identify. Moreover, the origin of CH_4 in gas hydrate is also unclear. Based on the nature of iodine element and isotope as mentioned above, they have important potential and application prospect for identification and provenance analyses of gas hydrate in the South China Sea.

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