1 Introduction

A solid water phase enclosing gas is termed gas hydrate and the water lattice in such a substance is oriented in clathrate. It can form naturally given proper physical conditions and the concentrations of light hydrocarbon gases exceeding interstitial water saturation.

The seabed offshore southwestern Taiwan (SW Taiwan) is characterized by a series of anticlines and faults. This deformation zone is located at the frontal edge of the accretionary wedge of the Luzon Arc and the China passive continental margin subduction-collision system. Geophysical surveys show that intensive Bottom Simulating Reflectors (BSRs) are distributed in a wide area of offshore southwestern Taiwan (Liu et al., 2004, 2006). This indicates abundant gas hydrate deposits may exist in the sediments of both the passive and active continental margins offshore of SW Taiwan. The occurrence of a series of normal faults intersected by thrust faults in this accretionary prism could be good conduits for gas and fluids venting upward to the surface. Numerous mud volcanoes and diapiric intrusion have been found along tectonic structures both onshore and offshore of southwestern Taiwan (Chiu et al., 2006; Chow et al., 2000), suggesting a massive release of methane had occurred there. Previous 18O analysis of seep carbonate from NE Dongsha area demonstrated that episodic dissociation of locally abundant gas hydrate happened and it was corresponding to sea-level changes (Tong et al., 2013). Therefore, SW Taiwan has been listed as one of the most potential gas hydrate areas in the South China Sea (SCS) and its storage conditions are of significant concern.

2 Sampling

Sediment column DH_CL_11 was collected by the Chinese research vessel “Haiyang 4”, during the HY4-2012-06 cruise. Upon retrieval, it showed intense degassing and had a strong hydrothion smell.

3 Results and Discussion

3.1 Salinity

The salinity of the interstitial water in situ for column DH_CL_11 is 35.39‰, which reveals an average value of the global ocean salinity. The salinity from the upper section (above 300 cmbsf) fluctuates less regularly and shows a vague increasing trend. However, a much more obvious decreasing trend is shown when it turns to layers below 500 cmbsf. Between the two depths, there is a transition zone (Fig. 1A). Nevertheless, the overall pore water salinity of the whole column presents a week declining trend, and the slope of the fitting line is $-0.0033$ (Fig. 1B).

The formation and decomposition of gas hydrate induce changes in the in situ salinity of the interstitial water. Irons are excluded during formation, thus increasing ionic concentrations of the remaining pore fluids. Conversely, gas hydrate dissociation causes intensive fluidization and decreases pore water salinity. Therefore, the salinity trend depicted above indicates that there is gas hydrate in column DH_CL_11 and it is venting when collected.

3.2 δ13C and δ18O of bulk sediments

Geochemistry of the pore fluids which directly affects the sediment can also be modified by formation/dissociation of gas hydrate. Gas hydrate trap preferentially 18O-rich water molecules, therefore the decomposition of...
Gas hydrate liberates $^{18}$O-rich fresh water. Seen from Fig. 2, $\delta^{18}$O the bulk sediment increases with depth, indicating gas hydrate dissociation (Fig. 2). The sharp decrease of $\delta^{13}$C below 600 cm is relevant with the anaerobic oxidation of methane (AOM) process, suggesting that the sulfate-methane interface (SMI) locates nearby.

4 Conclusion

(1) The overall decreasing trend of pore water salinity and the transition zone in column DH_CL_11 indicate gas hydrate dissociation.

(2) The sharp decrease of $\delta^{13}$C below 600 cmbsf, coupled with $\delta^{18}$O increase was observed. These are considered as evidences for the presence of a methane venting source may fed from dissociation of gas hydrates and/or a deeper gas reservoir.

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References


