Investigation of carbon cycle in the historical methane seepage in Dongsha Area, Northern South China Sea

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Methane seepage records the message of local carbon cycle and directly points to the deep hydrocarbon reservoir. The investigation of the seepage is thus significant to the exploration of petroleum, gas and gas hydrate and to the understanding of paleo-environmental conditions. The sediments and distribution of solutes in interstitial water were analyzed to reveal the activities of seepage in the Dongsha Area, Northern slop of the South China Sea. The low content of organic carbons in the sediments indicated local methane mainly source of deep reservoir rather than in situ degradation of organic carbon. Further, there are one to five carbonate-rich layers at each investigated site. The multilayer of carbonates demonstrated the episodic eruption or venting of deep hydrocarbon reservoirs. The episodic venting forms active or dormant seepages during the geological time. A numerical model was developed to simulate the distribution of solutes and derive the reaction rates. The model concentrations matched the field data and the fitting kinetic rates were determined. Through simulation the local carbon cycle which is methane to dissolved inorganic carbon to the carbonates was confirmed. The rate of local gas irrigation, dissolution, geochemical reactions and benthic flux was obtained and the episode of seepage was also quantitatively recognized.