The Occurrence and Distribution of Gas Hydrate Controlled by Mixed and Superposed Gas Sources in the Pearl River Mouth Basin, South China Sea

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Abstract

High concentrated and heterogeneous distribution of gas hydrate have been found from three dimensional (3D) seismic data in the Pearl River Mouth Basin, South China Sea (SCS). Several distinct classes of bottom simulating reflectors (BSRs) have been identified from the 3D seismic data. These include continuous BSRs, discontinuous BSRs, pluming BSRs and regional double BSRs. Gas hydrate identified from various parts of reservoir shows different thickness just above the base of gas hydrate stability with variable saturations. High-resolution broadband inversion was conducted based on the high-resolution velocity analysis, which dramatically increased the accuracy in detecting thin gas hydrate-bearing layers. Rock physical models and geostatistical inversion by creating multivariate probability density functions were involved to quantitatively predict gas hydrate saturation, porosity and the thickness of the reservoir. To show difference of gas hydrate reservoir, our study showed that the anomalies of gas hydrate-bearing sediments are not only caused by complex processes of sedimentation, erosion and slope failures, but also related with the fluid migration from the deeper sediments. A large number of faults are found from the coherence, RMS, dip attributes extracted from the new processed 3D seismic data. By integrating the oil & gas well log data with gas hydrate drilling data, we model the formation, distribution and saturation using the lithology, porosity, temperature, and total organic content (TOC) and hydrogen index in the Pearl River Mouth Basin. The results show that gas hydrate

near Site SH_2 is mainly related to biogenic gas with a 25-m-thick and an average saturation of 30% of the pore space, while thermogenic gas from deeper sediments migrating along normal faults, diapirs and chimneys contributes to higher saturation (60%) gas hydrate layer. That means that the biogenic gas controls the spatial distribution with low saturation, while the thermogenic gas contributes to high saturation.