

Sedimentation-reaction Process in Shenhu Area and Quantitative Assessment of Controlling Factors for Local Hydrate-bearing Reservoirs

Jinan Guan¹, Deqing Liang¹, and Lihua Wan²

¹Guangzhou Institute of Energy Conversion

²Guangzhou Institute of Energy Conversion, CAS

November 24, 2022

Abstract

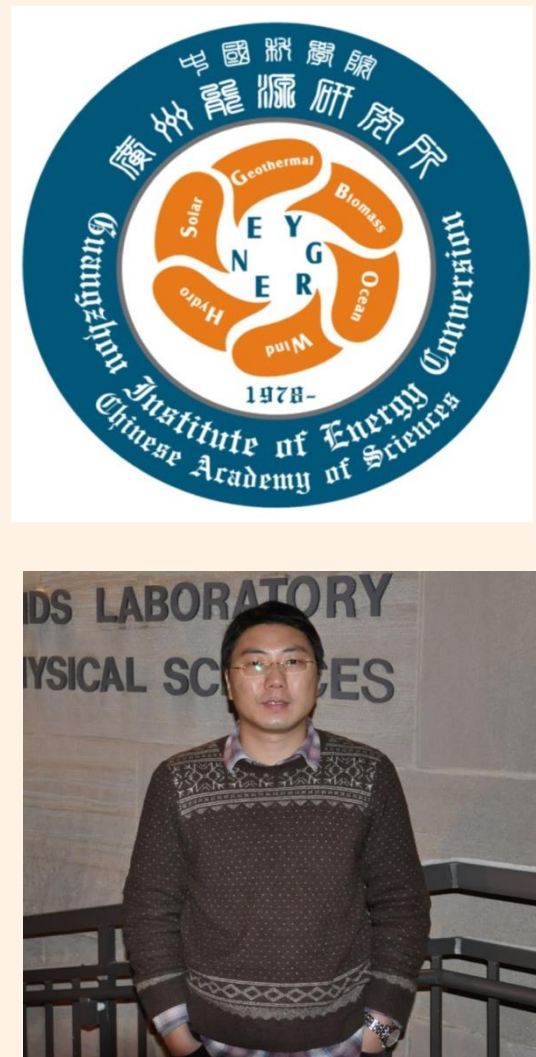
The Shenhu hydrate reservoirs of northern South China Sea are speculated to form and accumulate under the free gas-rich environment, and accord with the flow-transportation-reaction process. During this process, the area has also experienced simultaneous alternations of the local geological structures and ambient environmental conditions. First-order reaction kinetics, which controls the hydrate reaction, is coupled with the seafloor sedimentation to quest the dynamic formation and aggregation mechanism of the Shenhu hydrate layers. Firstly, based on the indications from Peclet number, the hydrate reaction shall play more active roles during the natural sedimentation in this process. Secondly, when the average seafloor sedimentation rate and the initial seafloor were 5 cm/ka and 988 m, respectively, three moments (50 ka, 3 Ma, and 5 Ma) are chosen to investigate the evolution process of the hydrate reservoirs and exhibit the change of the local pressures, temperatures, dissolved methane and salt, phase saturations, stratum permeability, and pore capillary pressure. The results show that after 5 Ma the occurrence and distribution of hydrate-bearing sediments proceed to be nearly consistent with the current status. Finally, the effects of five factors, including methane flux, kinetic coefficient, initial fluid position, permeability and seafloor sedimentation rate which simultaneously control the accumulation together in this zone, are quantitatively discussed. It verifies that the reaction-sedimentation mechanism is applicable for researching the Shenhu hydrate system. Under this model it should have a small methane flux and relatively small reaction coefficient here.

Sedimentation-reaction process in Shenhu area and quantitative assessment of controlling factors for local hydrate-bearing reservoirs (No.:OS31F-1865)

Jinan Guan*, Lihua Wan, and Deqing Liang

Key Laboratory of Gas Hydrate, Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, Guangzhou 510640, China.

Correspondence to:
guanja@ms.giec.ac.cn



1

Introduction and background

◆Five types of gas hydrates, including thick-bedded, disseminated, plaque, near fault and thin-bedded have been identified in Shenhu area, northern slope of South China Sea;

◆Different with stratigraphic-diffusive types of hydrates, the structural-seepage types of hydrates are generated by thermogenic methane vertically migrated from deep strata through faults.

◆The research area and the phase districts are:

◆The seafloor changes are simplified as:

$$P_b = P_0 + V_s \times t \times G_d$$

2

The dynamic evolution process

$t = 50 \text{ ka} \quad 3 \text{ Ma} \quad 5 \text{ Ma}$

3

The formation characteristics

4

The local geothermal field

5

The comparison of controlling factors

6

The effects of local sedimentation

7

Conclusions

- ◆ Structural-seepage methane hydrates are most massive and valuable in Shenhu area.
- ◆ Formation kinetics determines aggregation, while sedimentation changes occurrence.
- ◆ Active generation accompanying sedimentation dominates reservoir formation pattern.
- ◆ Evolution process and key factor assessment gauge local hydrate formation dynamics.
- ◆ Small methane flux and relatively slow reaction is preferentially recommended here.

✓ Please refer to: Guan et al., 2018. Gauging formation dynamics of structural-seepage methane hydrate reservoirs in Shenhu area of northern South China Sea: impact of seafloor sedimentation and assessment of controlling factors. Marine and Petroleum Geology, in reviewing.