



China Geology

Journal homepage: <http://chinageology.cgs.cn>



Research Advances

New delineation of two favorable zones for gas hydrate in southern Qinghai and northern Tibet, China

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1. Objectives

Southern Qinghai-northern Tibet permafrost region is a place having the most widespread and most developed permafrost in China with good mineralization conditions and prospecting potentials for gas hydrate (Zhu YH et al., 2011). In 2011, China Geological Survey initiated a special national program entitled “Gas hydrate resource exploration and trial mining”, which signaled a prelude to a comprehensive gas hydrate survey in southern Qinghai-northern Tibet permafrost region. So far, appreciable progress has been made in the geological, geophysical, geochemical and drilling survey across a number of key blocks. This paper is intended to examine the fundamental conditions for gas hydrate mineralization based on previous findings, delineate favorable zones for gas hydrate mineralization, and to make contributions to the onshore gas hydrate resource exploration in China.

2. Methods

After many years of practice, China has formed its own onshore gas hydrate survey methods characterized by a plane-line-point combination. The survey is based on hydrate accumulation system theory, focused on the main controlling factors of the accumulation, and supported by geological, geochemical, geophysical and drilling survey.

3. Results

1:50000 gas hydrate geological survey was conducted in key blocks across Shenglihe, Biluocuo, Yahu, Suonahu, Tumen and Tucuo, which are shown the stratigraphic

sequences, established the preliminary stratigraphic frameworks and identified the structural features and styles. Regional geological surveys are able to shortlist favorable zones for gas hydrate, after block survey and integrated geochemical-geophysical survey to delineate favorable zones for gas hydrate.

Ten gas hydrate test drilling wells were drilled in southern Qinghai-northern Tibet, which identified the strata lithology, permafrost thickness, geothermal gradient, source rocks and reservoir properties in the drill holes. In Yahu, QK-6 and QK-7 revealed the first high-pressure shallow gas. In Quemocuo, QK-8 was discovered good hydrocarbon gas signatures in the Upper Triassic Bagong, and Bolila Formations were detected with maximum total hydrocarbon (TG) of 5.349%. In Wuli, TK-2 and TK-3 were detected suspected CO₂ type hydrate (Liu SQ et al., 2017). After preliminarily identifying the main controlling factors for the gas hydrate in southern Qinghai-northern Tibet on basis of “point” breakthroughs, two gas hydrate mineralization models were established for the “Qilianshan style” fault system and mud volcano system. On the basis of the two gas hydrate mineralization models, two main favorable zones were delineated in the Qiangtang Basin (Fig. 1): One is a favorable zone for gas hydrate enrichment in eastern Qiangtang, for example, the Yahu–Quemocuo–Maqu–Tuotuohe gas hydrate mineralization zone. The other is a favorable zone for mud volcano escape and accumulation in western Qiangtang.

4. Conclusions

The southern Qinghai-northern Tibetan region is a place having the best onshore gas hydrate mineralization conditions and prospecting potentials in China. Establishment of the gas hydrate mineralization models and delineation of the favorable zones provide basis for subsequent work deployment and will definitely contribute to the onshore gas hydrate resource survey and evaluation in China.

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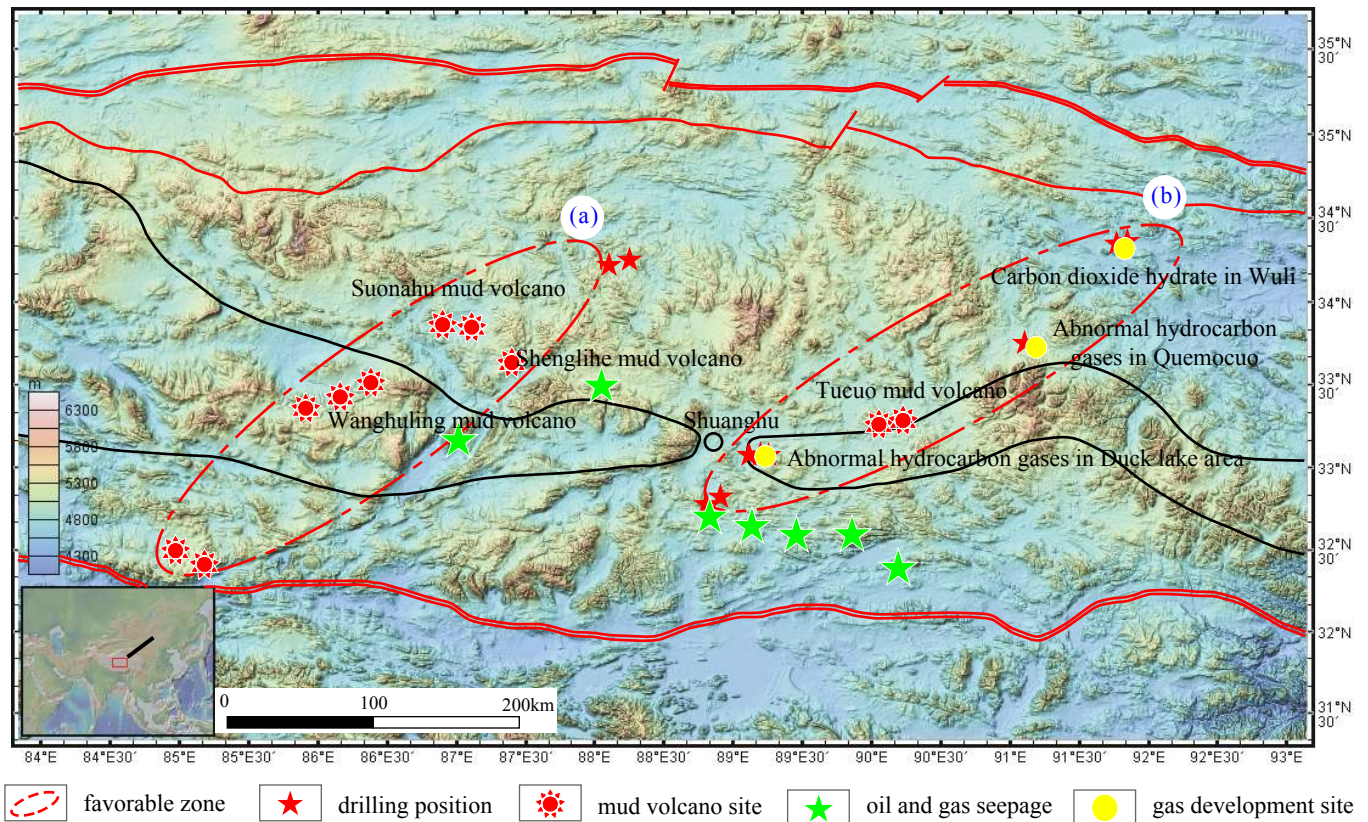


Fig. 1. Two favorable zones for gas hydrate delineated in southern Qinghai-northern Tibet permafrost region. (a). Favorable zone for hydrocarbon gas in eastern Qiangtang. (b) Favorable zone for mud volcano escape and accumulation in western Qiangtang.

Acknowledgements

We want to thank researchers Tan Fu-wen and Fu Xiu-gen of China Geological Survey Chengdu Geological Investigation Center for their valuable opinions and suggestions during our research. We also want to thank Drs Yang Zhi-bin and Wang Da-yong of Chinese Academy of Geological Sciences Institute of Geophysical and Geochemical Exploration for providing geochemical, HACSAMT and 2D seismic data.

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