

ZHU Chaoqi and Jia Yonggang, 2017. In-situ Observations of Engineering Geological Environment During Hydrate Production Tests in Deepwater. *Acta Geologica Sinica* (English Edition), 91(supp. 1): 193-194.

In-situ Observations of Engineering Geological Environment during Hydrate Production Tests in Deepwater

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Gas hydrates are ice-like combinations of methane and water. The global inventory of gas hydrates appears to be very large. Recent estimates of the total amount of methane contained in the world's gas hydrates range from 1500 to 15,000 gigatonnes of carbon. The amount of carbon in gas hydrates is 2 times larger than that present in all known fossil fuel deposit (coal, oil, and natural gas). It may power the mankind for the next 1,000 years. About 97%~98% of natural gas hydrate distribute in continental slope and continental rise, the rest in permafrost zones of Qilian Mountain and Western Siberia (Jia et al., 2016).

In China, the gas hydrate samples were first recovered in Shenhu area, the northern slope of South China Sea, in 2007 (Zhang et al., 2007). In 2008, hydrate samples were found in Qilian Mountain. Recently, hydrate samples were recovered in Dongsha and other areas in the northern South China Sea in 2013 and 2015 (Fig. 1).

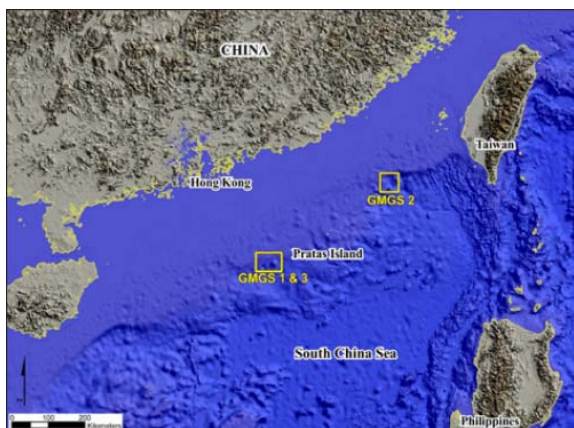


Fig. 1. Locations of gas hydrates found in the South China Sea (modified after Zhang et al., 2015).

Due to a series of potential environmental effects associated with gas hydrate, people remain cautious about gas hydrate production. We introduced the existing gas hydrate production tests in the Malik Field, Ignik Sikumi and Nankai Trough. Moreover, we reviewed the potential geohazards associated with gas hydrate, including the naturally-occurring geohazards and industrially-occurring geohazards. The gas hydrate seafloor observations in Nankai Trough production test by Japan and Mississippi Canyon Block 118 by USA were introduced. Further, we highlighted our in-situ observation equipment that will be used to monitor engineering geological environment during hydrate production tests in China (Fig. 2).



Fig. 2. Observation equipment during forthcoming hydrate production tests in China

The observation indexes are composed of bulk density, resistivity, water content, pore pressure, current speed, turbidity, seabed elevation. The gas hydrate seafloor observations still face many challenges, such as horizontal seabed deformation observation (Zhu et al., 2017). As an attractive alternative energy source, gas hydrate has been attracting attention from the academic and industry.

Acknowledgements

This study was funded by National Natural Science Foundation of China (41427803)

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