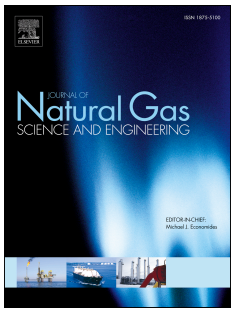
Accepted Manuscript



New insight into origin, accumulation and escape of natural gas in the Songdong and Baodao regions in the eastern Qiongdongnan basin, South China Sea

Ao Su, Honghan Chen, Xu Chen, Hongping Liu, Yanhua Liu, Mingzhu Lei

PII: S1875-5100(18)30040-4

DOI: 10.1016/j.jngse.2018.01.026

Reference: JNGSE 2433

To appear in: *Journal of Natural Gas Science and Engineering*

Received Date: 11 September 2017

Revised Date: 14 January 2018

Accepted Date: 24 January 2018

Please cite this article as: Su, A., Chen, H., Chen, X., Liu, H., Liu, Y., Lei, M., New insight into origin, accumulation and escape of natural gas in the Songdong and Baodao regions in the eastern Qiongdongnan basin, South China Sea, *Journal of Natural Gas Science & Engineering* (2018), doi: 10.1016/j.jngse.2018.01.026.

New insight into origin, accumulation and escape of natural gas in the Songdong and Baodao regions in the eastern Qiongdongnan basin, South China Sea

Ao Su [1], Honghan Chen [1*], Xu Chen[2*], Hongping Liu [1], Yanhua Liu [1], Mingzhu Lei[3]

(1. Key Laboratory of Tectonics and Petroleum Resource of Educational Ministry, China University of Geosciences, Hubei Wuhan 430074, China;

2. Yangtze University, Hubei Wuhan, 430100;

3. Zhanjiang Branch, CNOOC China Limited, Guangdong Zhanjiang 524057,China)

Abstract: The found gas pools in the Songdong and Baodao regions in the eastern Qiongdongnan basin, South China Sea have almost failed to realize expected commercial value due to either low reserve abundance or high carbon dioxide (CO_2) content. To assist in further exploration, the genetic type, source and accumulation history of natural gas have been investigated based on the analysis of the chemical compositions, carbon isotopes and light hydrocarbons in gases, isotope compositions of rare gas, basin numerical modeling and fluid inclusion analysis. The results indicate that there are three representative types of gases. The first type distributed in the BD13 and ST24-1 areas consists of biogenic and oil-derived gases from the Songdong sag. The second type distributed in the BD19-2 area is composed of coal-derived and oil-derived gases from the Baodao sag. The third type distributed in the BD15-3, BD19-4 and BD19-2 areas consists of significant amounts of volcanic mantle-derived CO_2 and few organic hydrocarbon gases. The charge of oil-derived gas and formation of biogenic gas are close to the deposition stage of overlying thick mudstones. This may be a critical factor for current gas pools with low reserve abundance in the Songdong region. Intense activity of the No.2 fault and absence of overlying thick mudstones gave rise to the escape of a large quantity of oil and gas from the middle Oligocene to middle Miocene. Besides, due to volcanic activity in the Quaternary, mantle-derived CO_2 was injected into the reservoirs via No.2 fault. The previous accumulative hydrocarbon gases were driven off by CO_2 in various degrees, which may be mainly responsible for current situation that most gas pools have high CO_2 content in the Baodao region.

Keywords: Gas origin, charge and escape; Qiongdongnan basin; South China Sea

1 Introduction

The commercial discovery of the large YC13-1 gas field in the shallow water area in the western Qiongdongnan Basin, South China Sea, indicates a good prospect for gas resources (Zhu et al., 2009). However, most gas pools in the Songdong and Baodao regions in the eastern Qiongdongnan Basin are characterized by low reserve abundance or high CO_2 content and fail to contain commercially viable hydrocarbon gas volumes. Theses indicate that there is a very complicated accumulation of natural gas. Besides, the existence of the Eocene lacustrine

Corresponding author. E-mail addresses: hhchen@cug.edu.cn (H. Chen), 421012100@qq.com(X. Chen).