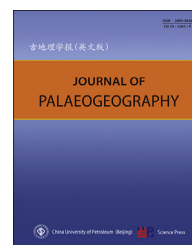


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Palaeogeography and mineral resources

A facies and palaeogeography-based approach for analysis of petroleum systems in United Arab Emirates

Shu-Zheng Yin, Guo-Ping Bai*, Lin Gao, Chuan-Yang Xu

College of Geosciences, China University of Petroleum (Beijing), Beijing 102249, China

Abstract The United Arab Emirates (UAE) is the 8th largest oil producing country and is rich in oil and gas resources. By the end of 2015, 68 oil and 23 gas fields had been discovered. The initial proved and probable (2P) oil, gas and condensate reserves amount to 81,135.9 MMb (million barrels), 192.09 Tcf (trillion cubic feet), and 6496.58 MMb respectively, which are mostly reservoirs in the Jurassic and Cretaceous carbonates. With the latest field data, this study attempts to document the salient features of petroleum systems in UAE. Based on depositional facies of source rock intervals, pods of source rocks were delineated. On the basis of an oil and gas-source correlation, five known petroleum systems were identified and they are Lower Silurian–Upper Permian Khuff gas, northeast foreland Upper Jurassic–Lower Cretaceous gas, Upper Jurassic–Jurassic petroleum, Upper Jurassic/Lower Cretaceous–Lower Cretaceous composite petroleum, and Middle Cretaceous–Middle to Upper Cretaceous/Cenozoic petroleum systems. Of them, the Upper Jurassic/Lower Cretaceous–Lower Cretaceous composite petroleum system contains 73.2% of the total 2P reserves and thus it is the focus of this study. The Upper Jurassic and Lower Cretaceous source rocks consist of argillaceous limestone, mudstone and shale, which were deposited as intrashelf basin facies. The distribution of oil and gas in this system is controlled by the source kitchens and the regional evaporite seal.

Keywords UAE, Carbonate reservoir, Intrashelf basin, Petroleum system, Evaporite seal

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1. Introduction

The United Arab Emirates (UAE) produced 182.4 million tonnes of oil (or 4.07 MMb/day) in 2016 and was

ranked 8th in the world (BP, 2017). It is rich in oil and gas resources. Since the discovery of its first oil field—the Bab Field in 1954, a total of 68 oil fields and 23 gas fields has been discovered in UAE by the end of 2015 (Fig. 1). They host a total of initial proved and

* Corresponding author.

E-mail address: baigp@cup.edu.cn (G.-P. Bai).

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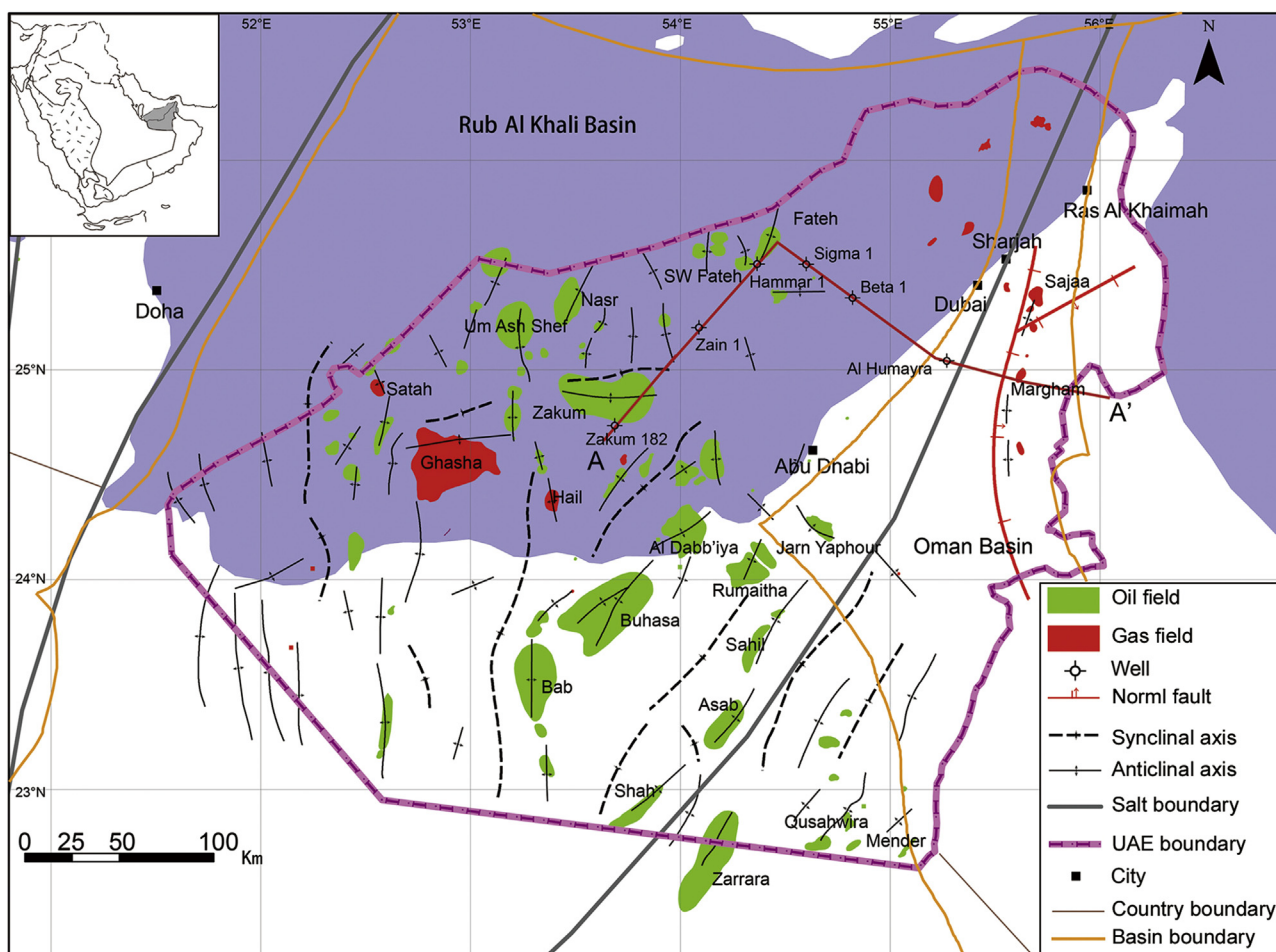


Fig. 1 Major structures and oil and gas fields in UAE (modified from Alsharhan, 1993). Note: A–A' marks the location of the geological cross section shown in Fig. 2.

probable (2P) reserves of 81,135.9 Mmb of oil, 192.09 Tcf of gas and 6496.58 MMB of condensate, which amount to 119,775.0 MMboe (million barrels oil equivalent). As UAE is a major oil producing country, its general petroleum geology has been extensively studied by a number of authors including Alsharhan (1989), Alsharhan and Kendall (1995), Alsharhan and Nairn (1997) and Glennie (2010). However, the petroleum systems in UAE have not been systematically documented in the public domain. With the latest data of oil and gas fields and results of previous studies of source rocks and depositional facies, this study attempts to document the distribution of petroleum systems and their salient features in UAE.

2. Synopsis of petroleum geology

UAE lies in the western and central parts of the Rub Al Khali Basin, with the Oman Basin in its eastern part

and the Oman Mountains in its northeastern corner (Fig. 1). According to Sharland *et al.* (2001), the ophiolite abduction in Late Cretaceous to Early Cenozoic and the subsequent collision of the Arabian Plate with the Eurasian Plate led to the development of folds and thrusts in the Oman Basin (Fig. 2). Most of the discovered fields are located in the Rub Al Khali Basin and the fields in the Oman Basin are dominated by gas discoveries (Fig. 1).

Based on IHS Energy and our in-house field data base, we carried out statistical analysis. The results indicate that the structural trap is the dominant type in UAE. The structural traps, which consist of anticlines, host 94.6% of the discovered 2P reserves and the rest 5.4% are contained in structural–stratigraphic combination traps. In the Rub Al Khali Basin, the formation of anticlines is attributed to two mechanisms: basement uplifting and salt movement. The anticlinal structures including Mender and Zarrarah anticlines in the southeastern part of UAE were formed by

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