



Reservoir controlling differences between consequent faults and antithetic faults in slope area outside of source: A case study of the south-central Wenan slope of Jizhong Depression, Bohai Bay Basin, East China



LIU Junqiao¹, WANG Haixue², LYU Yanfang², * SUN Tongwen², ZHANG Mengdi¹, HE Wei³, SUN Yonghe², ZHANG Tong⁴, WANG Chao¹, CAO Lanzhu⁵

1. College of Petroleum Engineering, Guangdong University of Petrochemical Technology, Maoming 525000;

2. College of Earth Science, Northeast Petroleum University, Daqing 163318, China;

3. Nanfang Branch of Sinopec Geophysical Corporation, Chengdu 610041, China;

4. Exploration and Development Research Institute of Daqing Oilfield Company, Daqing 163712, China;

5. PetroChina Huabei Oilfield Company, Renqiu 062552, China

Abstract: The control effects of different occurrence faults on oil and gas accumulation and distribution in the outer slope area of oil and gas reservoirs were studied taking the south-central Wen'an slope of the Jizhong depression in the Bohai Bay Basin as an example. Based on 3D seismic data and the distribution of oil and water, the controlling differences between consequent fault and antithetic fault were analyzed and compared from the formation and evolution rule of faults and the formation mechanism of fault traps, including development positions of the consequent fault traps and antithetic fault traps, oil and gas distribution horizon adjusted by fault and formation period of fault traps. The differences between consequent faults and antithetic faults in controlling reservoirs have three main aspects: (1) Consequent fault traps and antithetic fault traps are in different positions, the consequent fault traps are at the segmented growing point in the hanging wall of "hard-linkage" faults, while the antithetic fault traps are developed in the position with the largest throw in the footwall because of tilting action; (2) The two kinds of faults result in different oil and gas distribution vertically, oil and gas adjusted by consequent faults is distributed in a single layer or multi-layers, while oil and gas adjusted by antithetic faults occur in single layers; (3) The two kinds of fault traps are formed in different periods, the consequent fault traps are formed at the time when the related faults enter the stage of "hard-linkage", while the antithetic fault traps are formed at the beginning of the fault active period.

Key words: Bohai Bay Basin; Jizhong depression; slope area outside of source; consequent fault; antithetic fault; fault trap; transverse anticline; fault controlling hydrocarbon accumulation

Introduction

The slope area outside of source in oil and gas-bearing basin refers to the slope area which is beyond the distribution range of effective hydrocarbon source rock and some distance from the oil source sag^[1]. Generally, oil and gas generated by source rock can migrate laterally to the slope area along connected sand bodies and faults to accumulate in the corresponding traps^[2–3]. The different matching relation between faults, which are a common geological phenomenon, and the attitude of strata results in obvious differences in scale and distribution of oil and gas reservoirs near the faults^[4–7]. Con-

sequent faults and antithetic faults are two types of faults controlling the formation of oil and gas reservoirs common in the slope area, the former type has dip direction the same as the formation dip direction, and the latter has dip direction opposite to the formation dip direction. The roles of faults in oil and gas exploration were examined and discussed extensively, including the control function of fault to oil and gas migration as important migration pathway^[8–10], the transformation function to reservoirs^[11–12], the shielding function to oil and gas accumulation^[13–14], and so on. However, previous studies on the different functions of consequent and antithetic faults in sealing oil mainly focused on the control effect of fault seal-

Received date: 12 Jun. 2017; Revised date: 11 Nov. 2017.

* Corresponding author. E-mail: 571128lyf@nepu.edu.cn

Foundation item: Supported by the National Natural Science Foundation of China (41602129, 41602164); China National Science and Technology Major Project (2016ZX05007003, 2016ZX05006-005).

Copyright © 2018, Research Institute of Petroleum Exploration & Development, PetroChina. Publishing Services provided by Elsevier B.V. on behalf of KeAi Communications Co., Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

ing on oil and gas accumulation, which showed: the butt joint part between antithetic fault and reservoir is the gliding fracture zone, where the shelter sealing oil and gas migration is mudstone; while the butt joint between consequent fault and reservoir is the induced fracture zone, where the shelter blocking the oil and gas migration is fault rock; furthermore, from the perspective of displacement pressure of fault rock and reservoir rock, it is considered the lateral sealing ability of antithetic fault is stronger than that of consequent fault^[15–16]. Those studies analyzed the influence of the sealing ability of the consequent and antithetic faults on the preservation of the oil and gas only from the internal structure of the fracture zone and the geometric relation between the two walls of the faults. But the formation and evolution patterns and formation mechanisms of the faults haven't been investigated, which is undoubtedly unfavorable for in-depth study of fault-control-reservoir theory. In addition, previous studies suggested that

lithologic trap, stratigraphic trap and structural-lithologic trap are the main types of oil and gas traps in the slope area^[17–18], but the importance of fault trap in oil and gas exploration in slope area has been neglected. On the basis of previous studies, the authors examine the difference of consequent and antithetic faults in the slope area outside of source in controlling reservoir accumulation by studying the adjustment of oil and gas distribution layer by consequent and antithetic faults and the development site and formation period of the faults according to the formation and evolution rules of faults.

1. Geological survey

Located on the east side of the Baxian sag in the Jizhong depression of the Bohaiwan basin, the Wen'an slope is a NNE trending sedimentary slope uplifting in the east and dipping in the west (Fig. 1). From the bottom to top, there develop the Shahejie Formation and Dongying Formation of Paleogene

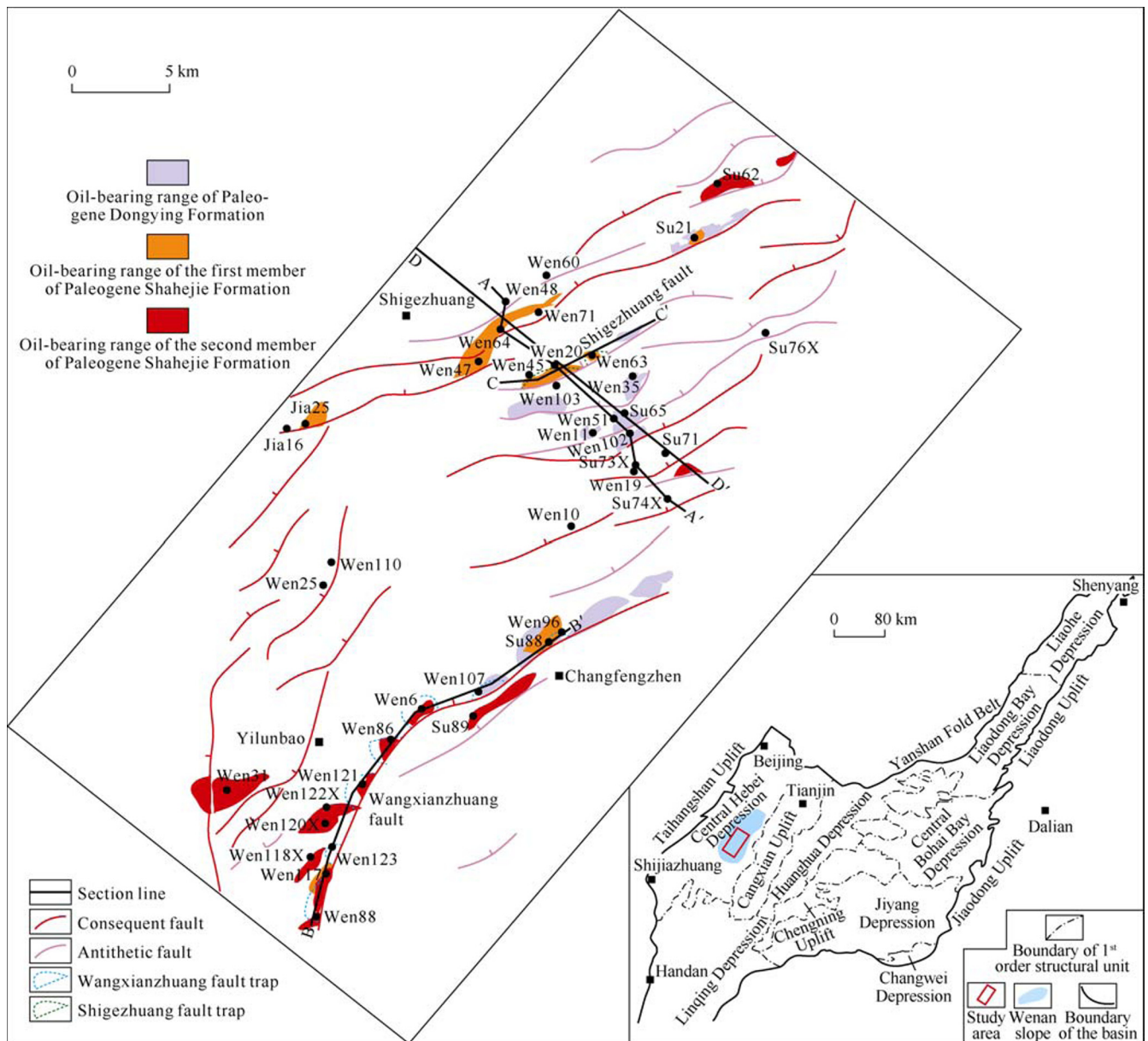


Fig. 1. The schematic diagram of structure and hydrocarbon distribution in the Wen'an slope.

Download English Version:

<https://daneshyari.com/en/article/8912181>

Download Persian Version:

<https://daneshyari.com/article/8912181>

[Daneshyari.com](https://daneshyari.com)