CAO Qian and ZHOU Wen, 2015. Characteristic and Controlling Factors of Organic Pores in Continental Shale Gas Reservoir of Chang 7th of Yanchang Formation, Ordos Basins. *Acta Geologica Sinica* (English Edition), 89(supp.): 1-2.

Characteristic and Controlling Factors of Organic Pores in Continental Shale Gas Reservoir of Chang 7th of Yanchang Formation, Ordos Basin

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The goals of this paper are to document the characteristics and controlling factors of organic pores distributed in continental shale reservoir of Chang 7th of Yanchang Formation in Ordos Basin. In this experiment, by using Argon ion polishing, SEM images and nitrogen adsorption experiment, more than 105 blocks samples were collected from the core of 399.04m from 18 wells, and 83 pieces of casting thin section were made. The TOC content of shale in the study area is mostly large than 2.0%, and the vitrinite reflectance (Ro) varies from 0.6% to 2.2%. The result shows the diameters of these organic pores are mainly less than 1μm, and the mid-value ranges from 0.1ìm to 0.2ìm (Fig. 1). Most of them commonly

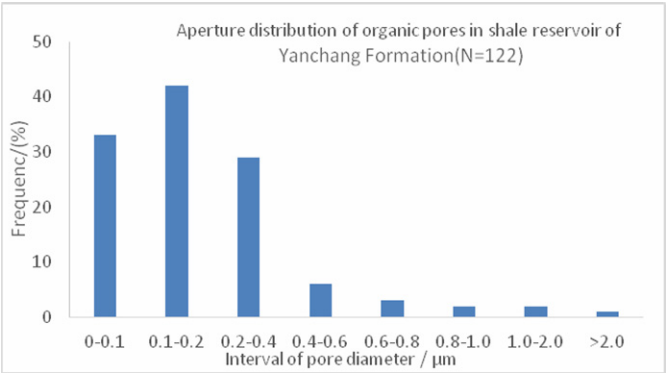

Fig. 1. The percentage of organic pores in Chang 7th shale reservoir of Yanchang Formation (N=122).

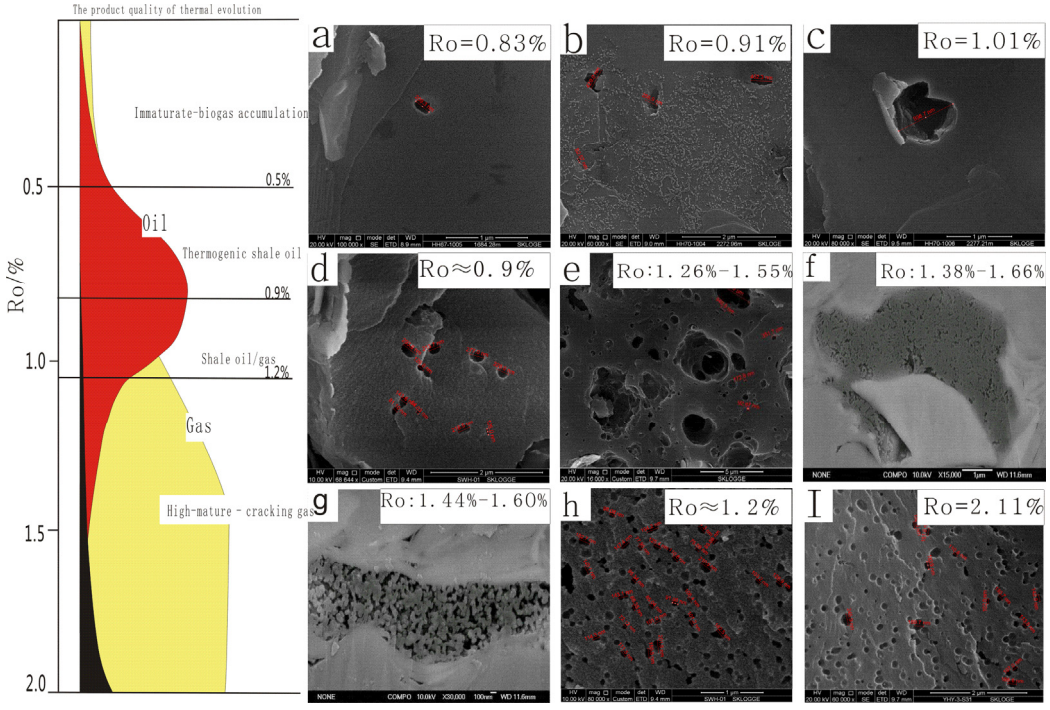

Fig. 2. Profile of Ro and organic pores of continental Shale of Chang 7th in Yangchang Formation, Ordos Basin.

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appear anisotropy, and they are irregular bubble-like, elliptical and elongated, irregular on the plane, parts of the organic pores are connected by each other (Fig. 2).With the value of Ro ranged from 0.6% to 2.2%, organic pores are developed in source rock with II kerogen, and formed in the different thermal evolution stages of organic hydrocarbon expulsion. Combined with the characteristics and genesis, organic pores can be divided into oil outlet pores, oil/gas outlet pores and "gas pores group".

With certain TOC content of shale in the study area, controlling factors of organic pores are vitrinite reflectances and rock brittleness index. The thermal evolution controls the development of organic pores by different vitrinite reflectances (Ro). The isolated oil outlet pores with the appearance of concave or ellipse shape in organic particles were formed when the thermal evaluation has reached to a Ro level of approximately 0.8% or higher (Figs. 2a, 2b). As the vitrinite reflectance (Ro) raised, the proportion of light oil increased and the isolated gas outlet pores were produced following (Fig 2-c, 2-d). When the value of Ro increased to about 0.9% or more, the content of cracking gas increased with the concentration increase of organic matter maturity, and part of natural gas dissolved in the oil, accompanied with a certain amount of free gas, numbers of randomly aggregated and dispersed gas outlet pores were produced and formed: "gas pores group" (Figs. 2-e, 2-f, 2-g, 2-h, 2-i), also part of them are connected in some extent. Besides, with six different samples which have total organic carbon (TOC) weights percentage between 2.0% and 4.0%, and the Ro levels range from 0.91% to 2.1%, this paper calculated the relatively brittleness indexes of the six samples combined the degree of diagenesis and evolution respectively by using mineral constituent method. From the relationship between relatively brittleness indexes and the number of organic pores observed in these samples, it shows that the stronger rock brittleness is, the more organic pores can be easily reserved.